IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Attorney Docket No. 16100US02

In the Application of:

Pieter van Rooyen et al.

U.S. Serial No.: 10/606,924

Filed: June 26, 2003

For: METHOD AND APPARATUS FOR SPACE-TIME TURBO-CODED MODULATION

Examiner: Sam K. Ahn

Group Art Unit: 2637

Confirmation No.: 3857

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APPEAL BRIEF

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Sir:

A Notice of Appeal was received by the United States Patent and Trademark Office on April 3, 2006 for the above-identified patent application. A Petition for a One-Month Extension is enclosed, thereby extending the deadline for filing an Appeal Brief to July 3, 2006.

07/05/2006 MBINAS 00000061 130017 10606924
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REAL PARTY IN INTEREST

Broadcom Corporation, a corporation organized under the laws of the state of California and having a place of business at 16215 Alton Parkway, Irvine, California 92618, has acquired the entire right, title and interest in and to the invention, the application, and any and all patents to be obtained therefor.

RELATED APPEALS AND INTERFERENCES

There are currently no appeals or interferences pending regarding related applications.

STATUS OF THE CLAIMS

Claims 1-18 are pending in the present application. Claims 1-17 are rejected. Claim 18 is allowed. The rejection of claims 1-17 is being appealed.

STATUS OF AMENDMENTS

No amendments are pending in the present application.

SUMMARY OF CLAIMED SUBJECT MATTER

Some embodiments according to some aspects of the present invention may provide, for example, a method that transmits a signal from a plurality of antennas. The method may include, for example, one or more of the following: encoding a stream of data according to a turbo multiple trellis coded modulation scheme thereby generating a plurality of parallel channel-coded symbol streams; space-time encoding the plurality of parallel channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams; and transmitting the plurality of space-time-channel-coded symbol streams from the plurality of antennas.

Some embodiments according to some aspects of the present invention may provide, for example, an apparatus that transmits a signal from a plurality of antennas.

The apparatus may include, for example, an outer encoder, an inner encoder and a plurality of antennas. The outer encoder may be configured, for example, to encode a stream of data according to a turbo multiple trellis coded modulation scheme, thereby generating a plurality of channel-coded symbol streams. The inner encoder may be configured, for example, to receive the channel-coded symbol streams and provide space-time coding to the channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams. The plurality of antennas may be coupled to the inner encoder. Each of the plurality of antennas may be configured, for example, to transmit one of the plurality of space-time-channel-coded symbol streams.

Some embodiments according to some aspects of the present invention may provide, for example, an apparatus that transmits a signal from a plurality of antennas. The apparatus may include, for example, channel encoding means, space-time encoding means and means for transmitting a plurality of space-time-channel-coded symbol streams from a plurality of antennas. The channel encoding means may encode a stream of data according to a turbo multiple trellis coded modulation scheme. The channel encoding means may be configured, for example, to generate a plurality of parallel channel-coded symbol streams. The space-time encoding means may space-time code the plurality of parallel channel-coded symbol streams. The space-time encoding means may be configured, for example, to generate the plurality of space-time-channel-coded symbol streams.

Some embodiments according to some aspects of the present invention may provide, for example, a method for communicating. The method may include, for example, one or more of the following: encoding a stream of data according to a turbo multiple trellis coded modulation scheme thereby generating a plurality of parallel channel-coded symbol streams; space-time encoding the plurality of parallel channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams; transmitting the plurality of space-time-channel-coded symbol streams from the plurality of antennas; receiving the plurality of space-time-channel-coded symbol streams; space-time decoding the plurality of received space-time-coded symbol streams, thereby generating a received channel-coded symbol stream; and decoding the

channel-coded symbol stream, thereby generating a received stream of data that corresponds to the stream of data.

Some embodiments according to some aspects of the present invention may provide, for example, a transceiver. The transceiver may include, for example, a transmitter portion and a receiving portion. The transmitter portion may include, for example, an outer encoder, an inner encoder and a plurality of antennas. The outer encoder may be configured, for example, to encode a stream of data according to a turbo multiple trellis coded modulation scheme, thereby generating a plurality of channel-coded symbol streams. The inner encoder may be configured, for example, to receive the channel-coded symbol streams and provide space-time coding to the channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams. The plurality of antennas may be coupled to the inner encoder. Each of the plurality of antennas may be configured, for example, to transmit one of the plurality of space-time-channel-coded symbol streams. The receiving portion may be housed with the transmitting portion. The receiving portion may include, for example, at least one antenna, a space-time decoder and a channel decoder. The at least one antenna may receive a plurality of transmitted space-time-channel-coded symbol streams, thereby generating a plurality of received space-time-channel-coded symbol streams. The space-time decoder may be coupled to the at least one antenna and may be configured, for example, to decode the plurality of received space-time-channel-coded symbol streams, thereby generating at least one channel-coded symbol stream. The channel decoder may be configured, for example, to decode the at least one channel coded symbol stream, thereby generating a stream of received data.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 1-4, 6, 9-11 are unpatentable under 35 U.S.C. § 102(e) as being anticipated by United States Patent No. 6,584,593 B1 to Nambirajan Seshadri et al. ("Seshadri").

Whether claims 5 and 7 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Seshadri in view of United States Patent Publication No. 2003/0043928 to Lin et al. ("Ling").

Whether claim 8 is unpatentable under 35 U.S.C. § 103(a) as being obvious over Seshadri in view of United States Patent No. 6,795,424 B1 to Kapoor et al. ("Kapoor").

Whether claim 12 is unpatentable under 35 U.S.C. § 103(a) as being obvious over Seshadri in view of United States Patent No. 6,785,861 B2 to Scalise et al. ("Scalise").

ARGUMENT

I. CLAIMS 1-4

A. Parallel Channel-Coded Symbol Streams

Appellants respectfully submit that Seshadri does not anticipate claim 1 since Seshadri does not describe each and every element as set forth in claim 1.

For example, claim 1 recites, in part, "encoding a stream of data according to a turbo multiple trellis coded modulation scheme thereby generating a plurality of parallel channel-coded symbol streams; space-time encoding the plurality of parallel channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams" (emphasis added).

Seshadri does not describe at least these elements as set forth in claim 1. Instead, Seshadri describes a TCM encoder 31 connected to an S-T encoder 32 as illustrated in FIG. 1 of Seshadri. Seshadri states that the TCM encoder 31 "is responsive to an input signal" and that the S-T encoder 31 "is responsive to encoder 31" and "provides symbols to antennas 33-34". Seshadri at col. 2, lines 35-39.

FIG. 2 of Seshadri illustrates the TCM encoder 31 in further detail. The TCM encoder 31 outputs (via its combiner 314) a combined, single string of bits to a space-time encoder 32. See, e.g., col. 2, lines 44-67 and FIGS. 1 and 2 of Seshadri.

Thus, according to the description in Seshadri (and even the Examiner does not dispute the description in Seshadri), the TCM encoder 31 outputs a combined, single string of bits to S-T encoder 32. Thus, the S-T encoder 32 does not encode the plurality of parallel channel-coded symbol streams allegedly generated by the TCM encoder 31.

Appellants respectfully submit that, in view of the description of Seshadri, Seshadri does not describe "encoding a stream of data according to a turbo multiple trellis coded modulation scheme thereby generating a plurality of parallel channel-coded symbol streams; space-time encoding the plurality of parallel channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams" (underlining added) as set forth in claim 1.

For at least the above reasons, Appellants respectfully submit that the Board reverse the anticipation rejection of claim 1 and its rejected dependent claims (i.e., claims 2-4).

B. Broadest Reasonable Interpretation

In the Office Action Made Final, the Examiner cites M.P.E.P. § 2106 which states that "[o]ffice personnel are to give claims their broadest reasonable interpretation in light of the supporting disclosure." M.P.E.P. § 2106 at page 2100-9 (Rev. 3, August 2005). The Examiner then states "[g]iving the broadest reasonable interpretation in light of the supporting disclosure, in this case, the combiner (314 in Fig.2) is part of the S-T Encoder (32 in Fig.1) receiving plurality of parallel channel-coded symbol streams (k systematic bits, q1 redundancy bits and q2 redundancy bits)."

In other words, the Examiner is alleging that, instead of giving the claims their broadest reasonable interpretation in light of Appellants' disclosure (e.g., the specification of Appellants' patent application) during examination as suggested by M.P.E.P. § 2106, the Examiner is attempting to give the broadest interpretation of the cited document (i.e., the Seshadri patent). It is possible that the Examiner may have misunderstood the phrase "supporting disclosure" as set forth in M.P.E.P. § 2106. Supporting disclosure is not the cited document (i.e., the Seshadri patent), but Appellants' disclosure (e.g., the specification of Appellants' patent application). See, e.g., M.P.E.P. § 2111 at page 2100-46 ("[d]uring patent examination, the pending claims must be "given *>their< broadest reasonable interpretation consistent with the specification").

Having said this, Appellants will neither confirm nor deny that the claims herein should be interpreted in view of Appellants' disclosure. Whether particular sections of the M.P.E.P. carry the weight of binding law in a particular judicial setting is a question for the relevant judicial forum. Instead, Appellants are merely pointing out that the

Examiner's position is opposed by the M.P.E.P.

For misapplying the M.P.E.P. § 2106 which served as the basis of the Examiner's anticipation rejection, the Board should reverse the anticipation rejection of claim 1 and its rejected dependent claims (i.e., claims 2-4)

Under such an alleged standard, to facilitate the anticipation rejection, the Examiner alleges that, according to the Seshadri patent, combiner 314 is part of S-T encoder 32. Appellants respectfully submit that this is an improper interpretation in view of the Seshadri patent.

M.P.E.P. § 2106 states that, during examination, "[o]ffice personnel must always remember to use the perspective of one of ordinary skill in the art". M.P.E.P. § 2106 at page 2100-8. M.P.E.P. § 2111 states that "[t]he broadest reasonable interpretation of the claims must also be consistent with the interpretation that those skilled in the art would reach." M.P.E.P. § 2111.01(II) states that the "ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention". M.P.E.P. § 2106(II)(C) states that the "[o]ffice personnel must always remember to use the perspective of one of ordinary skill in the art".

From the perspective of one of ordinary skill in the art, what is a turbo-trellis coded modulation (TCM) encoder and a space-time (S-T) encoder as used in the Examiner's interpretation of the Seshadri patent?

During the examination, the only evidence before the Examiner with respect to the anticipation rejection as to what one of ordinary skill in the art would consider a TCM encoder or an S-T encoder is the Seshadri patent itself.

The Seshadri patent clearly distinguishes between the TCM encoder 31 (called a TCM Mapper 31 in FIG. 1) and the S-T Encoder 32.

According to the only evidence (i.e., the Seshadri patent), before the Examiner in the anticipation rejection, of the perspective of one of ordinary skill in the art, the combiner 314 is part of the TCM encoder 31. Thus, according to the Seshadri patent, one of ordinary skill in the art would know that the combiner 314 is part of the TCM encoder 31.

According to the only evidence (i.e., the Seshadri patent), before the Examiner, of

the perspective of one of ordinary skill in the art, the TCM encoder 31 outputs (via its combiner 314) a combined, single string of bits to the S-T encoder 32. See, e.g., col. 2, lines 44-67 and FIGS. 1 and 2 of the Seshadri patent.

The Seshadri patent directly and specifically contradicts the Examiner's interpretation of the Seshadri patent. Accordingly, the perspective of one of ordinary skill in the art in view of the only evidence present in support of the anticipation rejection directly and specifically contradicts the Examiner's interpretation of the Seshadri patent.

Appellants respectfully submit that the Examiner should not have ignored the detailed description of the Seshadri patent because the Seshadri patent is the only evidence of one of ordinary skill in the art before the Examiner in the anticipation rejection and the Seshadri patent specifically and unambiguously articulates that the combiner 314 is part of the TCM encoder 31 and that a combined, single string of bits are sent from the TCM encoder 31 to the S-T encoder 32. Thus, the Examiner's interpretation of the description of the Seshadri patent should not stand.

It is therefore respectfully requested that the Board reverse the anticipation rejection of claim 1 and its rejected dependent claims (i.e., claims 2-4).

C. Multiple Trellis Coded Modulation Scheme

Claim 1 recites, in part, "encoding a stream of data according to a turbo multiple trellis coded modulation scheme" (underlining added).

As the title of Seshadri states, Seshadri relates to "TURBO-TCM". Appellants respectfully draw the attention of the Board to lack of the use of the term "multiple" anywhere in Seshadri.

It is true that FIG. 2 illustrates encoder 311 and encoder 313. However, these encoders 311, 313 are part of a single turbo-trellis coded modulation encoder 31.

Since Seshadri does not describe a turbo multiple trellis coded modulation scheme as set forth in claim 1, it is respectfully requested that the Board reverse the anticipation rejection of claim 1 and its rejected dependent claims (i.e., claims 2-4).

II. CLAIMS 13-16

Appellants respectfully submit that Seshadri does not anticipate claims 13 and 16 since Seshadri does not describe each and every element as set forth in claims 13 and 16.

Claim 13 recites, in part, "channel encoding means for encoding a stream of data according to a turbo multiple trellis coded modulation scheme, wherein the channel encoding means is configured to generate a plurality of parallel channel-coded symbol streams; space-time encoding means for space-time coding the plurality of parallel channel-coded symbol streams, wherein the space-time encoding means is configured to generate a plurality of space-time-channel-coded symbol streams" (underlining added).

Claim 16 recites, in part, "encoding a stream of data according to a turbo multiple trellis coded modulation scheme thereby generating a plurality of parallel channel-coded symbol streams; space-time encoding the plurality of parallel channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams" (underlining added).

For many of the same or similar reasons as stated with respect to claim 1, the anticipation rejection of claims 13 and its rejected dependent claims (i.e., claims 14 and 15) and claim 16 based on Seshadri should be reversed.

III. CLAIMS 6, 9-11 AND 17

Appellants respectfully submit that Seshadri does not anticipate claims 6 and 17 since Seshadri does not describe each and every element as set forth in claims 6 and 17.

Claim 6 recites, in part, "an outer encoder configured to encode a stream of data according to a turbo multiple trellis coded modulation scheme, thereby generating a plurality of channel-coded symbol streams; an inner encoder configured to receive the channel-coded symbol streams and provide space-time coding to the channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams".

Claim 17 recites, in part, "an outer encoder configured to encode a stream of data according to a turbo multiple trellis coded modulation scheme, thereby generating a plurality of channel-coded symbol streams; an inner encoder configured to receive the channel-coded symbol streams and provide space-time coding to the channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams".

Seshadri does not describe an inner coder configured to receive the channel-coded symbol streams generated by an outer coder. In Seshadri, because the combiner 314 is part of the turbo trellis coded modulation encoder 31, the S-T encoder 32 only receives a single stream. Where the Examiner attempts to interpret Seshadri beyond the description in Seshadri, Appellants respectfully make the arguments above in Section I, Subsection B herein.

Seshadri does not describe a turbo multiple trellis coded modulation scheme. Appellants respectfully make the arguments above in Section I, Subsection C herein.

For at least the above reasons, it is respectfully requested that the Board reverse the anticipation rejection of claim 6 and its rejection dependent claims (i.e., claims 9-11) and claim 17 based on Seshadri.

IV. CLAIMS 5, 7, 8 AND 12

Appellants respectfully requested that, in view of the teaching deficiencies of Seshadri with respect to claim 1, the Board should reverse the obviousness rejection as alleged by the Examiner with respect to claim 5.

Appellants respectfully submit that, in view of the teaching deficiencies of Seshadri with respect to claim 6, the Board should reverse the obviousness rejection as alleged by the Examiner with respect to claim 7, 8 and 12.

V. CONCLUSION

For the foregoing reasons, claims 1-17 are patentable over the alleged prior art of record. Reversal of the Examiner's rejection of claims 1-17 is therefore respectfully requested, thereby placing claims 1-18 in condition for allowance. Accordingly, issuance of a patent on the application is therefore respectfully requested.

The Commissioner is hereby authorized to charge any additional fees or credit any overpayment to the deposit account of McAndrews, Held & Malloy, Account No. 13-0017.

Dated: July 3, 2006

Respectfully submitted,

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CLAIMS APPENDIX

The following claims are involved in this appeal:

1. A method for transmitting a signal from a plurality of antennas comprising:

encoding a stream of data according to a turbo multiple trellis coded modulation scheme thereby generating a plurality of parallel channel-coded symbol streams;

space-time encoding the plurality of parallel channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams; and

transmitting the plurality of space-time-channel-coded symbol streams from the plurality of antennas.

2. The method of claim 1, wherein the space-time coding includes block space-time coding.

3. The method of claim 1, wherein the space-time coding includes convolutional space-time coding.

4. The method of claim 1, wherein the encoding the stream of data includes maximizing a coding gain and the space-time encoding includes maximizing diversity gain.

5. The method of claim 1, wherein the signal complies with a communication protocol selected from the group consisting of: orthogonal frequency division multiplexing (OFDM), time division multiple access (TDMA), code division multiple access (CDMA), gaussian minimum shift keying (GMSK), complementary code keying (CCK), quadrature phase shift keying (QPSK), frequency shift keying (FSK), phase shift keying (PSK), and quadrature amplitude modulation (QAM).

6. An apparatus for transmitting a signal from a plurality of antennas comprising:

an outer encoder configured to encode a stream of data according to a turbo multiple trellis coded modulation scheme, thereby generating a plurality of channel-coded symbol streams;

an inner encoder configured to receive the channel-coded symbol streams and provide space-time coding to the channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams; and

a plurality of antennas coupled to the inner encoder, wherein each of the plurality of antennas is configured to transmit one of the plurality of space-time-channel-coded symbol streams.

7. The apparatus of claim 6, wherein the outer encoder includes a plurality of parallel coding chains, wherein each of the coding chains includes a trellis coded modulation encoder, a block symbol interleaver and a QPSK mapper unit, wherein the plurality of coding chains generates the plurality of channel-coded symbol streams.

8. The apparatus of claim 6, wherein the plurality of antennas are arranged so that a fading correlation between the antennas is below 0.5.

9. The apparatus of claim 6, wherein the inner encoder is a block space-time encoder.

10. The apparatus of claim 6, wherein the inner encoder is a convolutional space-time encoder.

11. The apparatus of claim 6, wherein the outer encoder is configured to maximize coding gain and the inner encoder is configured to maximize diversity gain.

12. The apparatus of claim 6, including a symbol interleaver interposed between the outer encoder and the inner encoder.

13. An apparatus for transmitting a signal from a plurality of antennas comprising:

channel encoding means for encoding a stream of data according to a turbo multiple trellis coded modulation scheme, wherein the channel encoding means is configured to generate a plurality of parallel channel-coded symbol streams;

space-time encoding means for space-time coding the plurality of parallel channel-coded symbol streams, wherein the space-time encoding means is configured to generate a plurality of space-time-channel-coded symbol streams; and

means for transmitting the plurality of space-time-channel-coded symbol streams from the plurality of antennas.

14. The apparatus of claim 13, wherein the space-time encoding means includes means for block space-time coding.

15. The apparatus of claim 13, wherein the space-time encoding means includes means for convolutional space-time coding.

16. A method for communicating comprising:

encoding a stream of data according to a turbo multiple trellis coded modulation scheme thereby generating a plurality of parallel channel-coded symbol streams;

space-time encoding the plurality of parallel channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams;

transmitting the plurality of space-time-channel-coded symbol streams from the plurality of antennas;

receiving the plurality of space-time-channel-coded symbol streams;

space-time decoding the plurality of received space-time-coded symbol streams, thereby generating a received channel-coded symbol stream;

decoding the channel-coded symbol stream, thereby generating a received stream of data that corresponds to the stream of data.

17. A transceiver comprising:

a transmitter portion including:

an outer encoder configured to encode a stream of data according to a turbo multiple trellis coded modulation scheme, thereby generating a plurality of channel-coded symbol streams;

an inner encoder configured to receive the channel-coded symbol streams and provide space-time coding to the channel-coded symbol streams, thereby generating a plurality of space-time-channel-coded symbol streams;

a plurality of antennas coupled to the inner encoder, wherein each of the plurality of antennas is configured to transmit one of the plurality of space-time-channel-coded symbol streams; and

a receiving portion housed with the transmitting portion, the receiving portion comprising:

at least one antenna for receiving a plurality of transmitted space-time-channel--coded symbol streams, thereby generating a plurality of received space-time-channel-coded symbol streams;

a space-time decoder coupled to the at least one antenna, wherein the space-time decoder is configured to decode the plurality of received space-time-channel-coded symbol streams, thereby generating at least one channel-coded symbol stream; and

a channel decoder configured to decode the at least one channel coded symbol stream, thereby generating a stream of received data.

18. An apparatus for transmitting a signal comprising:

a QPSK mapper configured to receive input data;

a first MTCM encoder and QPSK mapper unit coupled to the QPSK mapper;

a first symbol selector and puncturer coupled to the first MTCM encoder and QPSK mapper unit, wherein the first symbol selector and puncturer is configured to provide a first channel-coded symbol stream;

a symbol interleaver coupled to the QPSK mapper;

a second MTCM encoder and QPSK mapper unit coupled to the symbol interleaver;

a symbol de-interleaver arrangement coupled to the second MTCM encoder and QPSK mapper unit;

a second symbol selector and puncturer coupled to the symbol de-interleaver arrangement, wherein the second symbol selector and puncturer is configured to provide a second channel-coded symbol stream;

an inner encoder coupled first and second symbol selector and puncturers, wherein the inner encoder is configured to receive the first and second channel-coded symbol streams and provide space-time coding to the first and second channel-coded symbol streams, thereby generating a first and a second space-time-channel-coded symbol streams; and

a plurality of antennas coupled to the inner encoder, wherein two of the plurality of antennas are each configured to transmit one of the first and second space-time-channel-coded symbol streams.